

WHAT IS CLAIMED IS:

1. A semiconductor device manufacturing method comprising:

forming a first insulating film including silicon,
5 carbon, nitrogen, and hydrogen above a substrate in a first chamber;

carrying the substrate into a second chamber other than the first chamber, and discharging a rare gas in the second chamber; and

10 forming a second insulating film including silicon, carbon, oxygen, and hydrogen above the first insulating film after the discharging the rare gas.

2. The semiconductor device manufacturing method according to claim 1, wherein the second chamber
15 includes a film including silicon and carbon, a film including silicon, carbon, and hydrogen, a film including silicon, carbon, and oxygen, or a film including silicon, carbon, oxygen, and hydrogen formed in advance.

20 3. The semiconductor device manufacturing method according to claim 2, wherein the film formed in the second chamber in advance fails to include nitrogen.

4. The semiconductor device manufacturing method according to claim 1, wherein a film thickness of the
25 first insulating film is thinner than that of the second insulating film.

5. The semiconductor device manufacturing method

according to claim 1, wherein the first and second insulating films are respectively formed in different chambers.

5 6. The semiconductor device manufacturing method according to claim 5, wherein the second insulating film is formed in the second chamber.

10 7. The semiconductor device manufacturing method according to claim 1, further comprising forming a third insulating film whose material is different from that of the second insulating film above the second insulating film.

15 8. The semiconductor device manufacturing method according to claim 2, wherein the carrying the substrate into the second chamber other than the first chamber, and discharging the rare gas in the second chamber comprises depositing a thin film on the first insulating film, the thin film being formed of material of the film formed in the second chamber in advance.

20 9. The semiconductor device manufacturing method according to claim 1, wherein the second insulating film is formed by a plasma CVD method or a applying method.

25 10. The semiconductor device manufacturing method according to claim 2, wherein the film is formed by a plasma CVD method in the second chamber in advance.

11. The semiconductor device manufacturing method according to claim 1, further comprising forming

a connection hole and wiring trench in a laminated insulating film including the first and second insulating films, and burying a conductive film in the connection hole and the wiring trench.

5 12. A semiconductor device manufacturing method comprising:

 forming a first insulating film including silicon, carbon, nitrogen, and hydrogen above a substrate;

 irradiating an energy ray on the first insulating
10 film; and

 forming a second insulating film including silicon, carbon, oxygen, and hydrogen by a plasma CVD method above the first insulating film after the irradiating the energy ray.

15 13. The semiconductor device manufacturing method according to claim 12, wherein the energy ray is an ultraviolet ray or an electron ray.

 14. The semiconductor device manufacturing method according to claim 12, further comprising heating the
20 substrate at the time of irradiating the energy ray on the first insulating film.

 15. The semiconductor device manufacturing method according to claim 12, further comprising forming a
25 third insulating film whose material is different from that of the second insulating film above the second insulating film.

 16. The semiconductor device manufacturing method

according to claim 12, further comprising forming a connection hole and wiring trench in a laminated insulating film including the first and second insulating films, and burying a conductive film in the connection hole and the wiring trench.

17. A semiconductor device manufacturing method comprising:

forming a first insulating film including silicon, carbon, nitrogen, and hydrogen above a substrate;

10 exposing the substrate in a humidified atmosphere including H₂O;

heating the substrate after the exposing the substrate; and

15 forming a second insulating film including silicon, carbon, oxygen, and hydrogen by a plasma CVD method above the first insulating film after the heating the substrate.

18. The semiconductor device manufacturing method according to claim 17, wherein the exposing the substrate in the humidified atmosphere is carried out under reduced pressure.

19. The semiconductor device manufacturing method according to claim 17, further comprising forming a third insulating film whose material is different from that of the second insulating film above the second insulating film.

20. The semiconductor device manufacturing method

according to claim 17, further comprising forming
a connection hole and wiring trench in a laminated
insulating film including the first and second
insulating films, and burying a conductive film in the
5 connection hole and the wiring trench.